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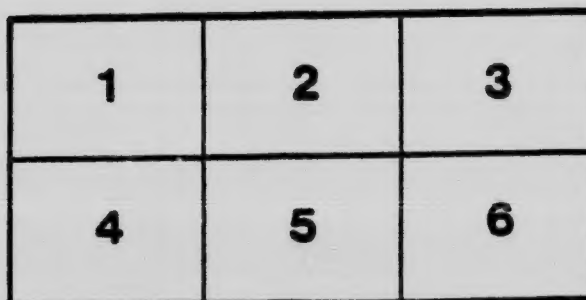
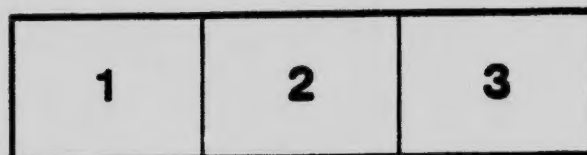
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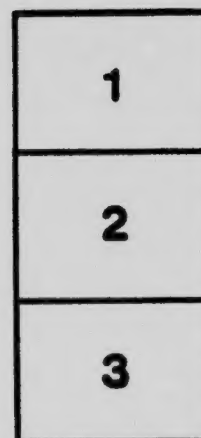
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DEPARTMENT OF MINES
MINES BRANCH

HON. W. TEMPLEMAN, MINISTER; A. P. LOW, LL.D., DEPUTY MINISTER;
EUGENE HAANEL, PH.D., DIRECTOR.

BULLETIN No. 7

WESTERN PORTION
OF
TORBROOK IRON ORE DEPOSITS,
ANNAPOLIS COUNTY, NOVA SCOTIA.

BY
Howells Fréchette, M.Sc.



OTTAWA
GOVERNMENT PRINTING BUREAU
1912

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Frontispice.

PLATE I.



General View, Tortosa valley.

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MAP.

No. 141. Map of Torbrook iron-bearing district, Annapolis county, Nova Scotia..	End.
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BY

The Nictaux-Torbrook iron ore deposits are situated on the southeastern side of the Annapolis valley, in Annapolis county, Nova Scotia, about 5 miles southeast of the Dominion Atlantic railway. The ore-bearing district extends southwestward from the line between Kings and Annapolis counties, for a distance of about 5 miles, and is slightly over a mile in width. The Nictaux river, flowing to the north, divides the area into two parts. That to the west of Nictaux river is known as the Nictaux district; while that to the east is known as the Torbrook district.

The history and general description of the iron ore deposits are dealt with by Dr. J. E. Woodman in his report on the "Iron Ore Deposits of Nova Scotia," part II, chapter II. The geology and stratigraphy are described by Prof. L. W. Bailey,² and the late Mr. Hugh Fletcher.³

The rocks of the district are dark grey and black slates and quartzites, with a few intrusions of diorite and granite.

During the summer of 1910, the southwestern portion of the Torbrook district was examined. Magnetometric and topographic surveys were made, covering an area 2 miles northwest and southeast by 1½ miles northeast and southwest, lying immediately to the east of the Nictaux river. The accompanying map (No. 141), which includes most of this area, has been prepared from the surveys made, and from the map accompanying Mr. Fletcher's report.

The northwestern portion of the area represented by the map has an altitude varying from 300 feet to 440 feet above sea-level, and the southeastern portion from 400 to 580 feet. Traversing the area is a valley, through which the To-brook or Black river flows, grading from 360 feet to 220 feet above the sea.

There are two parallel zones of ore, distant about one mile from one another: one of which is on the northwest side of the area under examination—which for convenience will be referred to as the 'north side;' while the other is across the valley of Black river, near the southeast side of the area—which will be referred to as the 'south side,' or, as it is locally known, 'South mountain.'

Both on South mountain and on the north side, numerous pits have been dug exposing the ore which is in beds conformable with the slates and quartzites

¹ Publication No. 20, Mines Branch, Department of Mines.

² Geological Survey Annual Report, Vol. IX, p. 91 M.

3 " " " " Vol. XVI, p. 302 A.

in which they occur. The strike of the beds is N. 40° E.¹ On the north side, there are two main beds dipping about 80° to the southeast. The northernmost of these—the 'Leckie bed'—is of hard hematite which is slightly magnetic. About 100 feet southeast of this is a bed of fossiliferous magnetite known as the 'Shell' bed. On South mountain only one bed is seen. The dip of this is from 73° to 87° to the northwest. The ore in most parts of this bed is a low grade magnetite, highly siliceous, and of a waxy lustre. Very few fossils are to be seen in it.

The slates, quartzites, and iron ore are all steeply inclined. It has been pointed out by previous observers that the strata lie in a syncline and that the ore bed on South mountain is, probably, identical with one of those on the north side.

Mr. Fletcher, in his report for 1905,² states that certain investigations at the old mines in the eastern portion of the Torbrook district seem to prove that the rocks lie in several synclines between the ore exposures on South mountain and those on the north side.

The dips of the strata at various points in the area shown on the accompanying map tend to indicate that multiple folding has also taken place here. These dips, which are very steep, may be misleading, as they are doubtless effected in some cases by nearby intrusives. At present, the evidence to be seen in the dip and sequence of the strata is insufficient to make it possible to state positively the nature of the structure.

If there is multiple folding and the folds are large, the ore beds might be expected to outcrop or approach within workable distance of the surface within the Black River basin.

Magnetometric Surveys.

Magnetometric surveys were made on both South mountain and on the north side, with lines of observation connecting.

SOUTH MOUNTAIN.

A base line 6,400 feet long, approximately following the line of pits in the South Mountain ore, was laid off, and cross lines were turned at intervals of 300 feet, and in some places intermediate lines were run. The length of the cross lines averaged 1,700 feet to the north of the base line, and 1,250 feet to the south. Magnetometric observations for vertical and horizontal intensity were made at intervals of 50 feet along these lines, and at such other points as were deemed necessary. It had been hoped to locate the presence of additional beds of ore, and discover lines along which these beds approach the surface, due to multiple folding. Unfortunately, no such results were obtained, but the known bed was traced from pit No. 1, on Obadiah Brown's farm, westward to Black river.

The magnetism of this bed is weak throughout most of its length. For a distance of 1,300 feet, with the exception of about 300 feet, it could not be traced magnetically, and as there were no pits within this stretch it could not be ascer-

¹ All bearings are referred to astronomic north.

² Summary Report of Geol. Survey, 1905, p. 120.

tained, without much trenching, whether the ore is continuous but non-magnetic, or absent.

The presence of two faults was observed. The first of these, marked No. 1 on the plan, offsets the bed about 100 feet to the northwest. The second fault, marked No. 2, is 730 feet southwest of the first, and offsets the bed about 55 feet to the southeast. From this point the bed was traced without interruption to the point where it crosses Black river, about 1,100 feet down stream from the mouth of a small creek which flows into Black river.

The maps issued with the reports of Fletcher and Woodman show an offset of the bed at Black river. The line of outcrop from the southwest is shown as meeting the river at the point 1,100 feet down stream from the mouth of the creek; but the line from the northeast is shown as meeting Black river at the mouth of the creek. This is certainly incorrect. No outcrop was found to the southeast of pit No. 13, nor did the magnetometer indicate magnetic disturbances.

NORTH SIDE.

A base line 8,850 feet long was run, parallel to the south base line, near the northside beds. Cross lines were run at intervals of from 50 feet to 200 feet, averaging in length 650 feet to the north of the base line and 450 feet to the south. Magnetometric readings were taken at intervals of 50 feet along these lines, and in the neighbourhood of the ore additional readings were taken every 12½ feet. The magnetometer indicated the presence of four magnetic beds more or less parallel to each other. The southeasternmost is the 'Shell' bed already mentioned, and indicated on the map as No. 1. This bed is strongly magnetic throughout its length in the area surveyed. About 65 feet to the northwest of the 'Shell' bed is No. 2 bed, which is only slightly magnetic in places. This is probably very narrow, and of no commercial value. No. 3 bed, lying about 100 feet northwest of No. 1, is the Leckie bed. It is somewhat more magnetic than No. 2, but cannot be traced continuously by means of the magnetometer. Varying in distance from about 350 feet to 750 feet to the northwest of No. 1 bed, is No. 4. The magnetism is very low, and the bed could only be traced for short distances. A trench which cuts this reveals the fact that it is only a bed of rather highly ferruginous slate.

The magnetometric survey indicated the presence of a number of faults, five of which are well defined and are shown on the plan. Following the beds from northeast to southwest, the first fault, No. 3, offsets the beds about 50 feet to the northwest. Eighteen hundred feet from No. 3 is No. 4 fault, the direction of which is almost due west. The offset is over 700 feet. No. 5 fault offsets the beds 50 feet to the northwest, and No. 6 offsets about 75 feet to the southeast. No. 7 fault is to the west of the Bloomington road. The offset here is about 70 feet to the southeast.

Contours of elevation above sea-level, for 10 ft. intervals, are shown in brown on the map.

Nature of Ore.

SOUTH MOUNTAIN

The following analyses, taken largely from Dr. Woodman's report, will serve to show the character of the ore on South mountain.

Analysis of South Mountain Iron Ore.

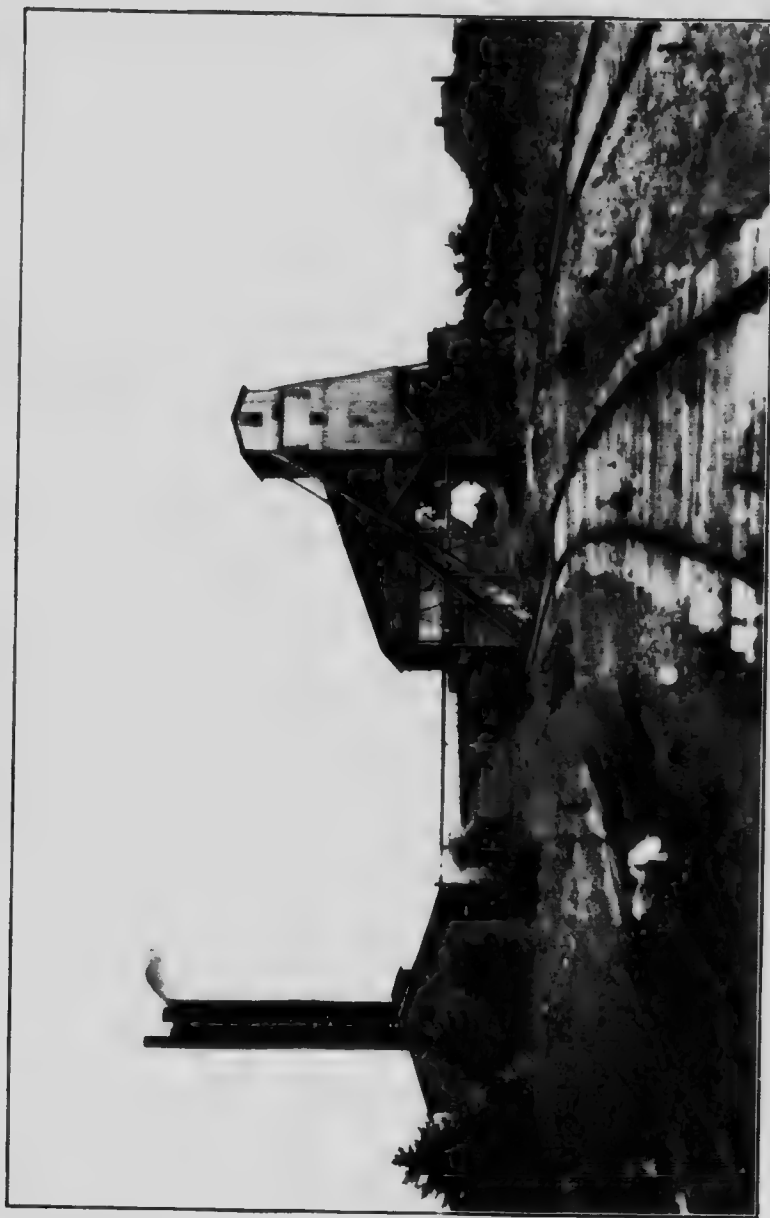
Sample No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Metallic iron.....	22.92	33.60	47.88	55.69	47.09	49.51	36.41	34.73	34.72	55.45	5.53	36.41	48.03	45.62	43.40	46.64	30.83
Insoluble matter.....	58.62	40.17	16.75	15.48	(20.20)	(19.56)			20.49	13.03	(12.03)		(19.11)	(22.16)			(33.16)
Alumina.....					3.70	5.46					2.50		6.20	4.93			
Lime.....				NI	4.55	2.15					0.95		2.95	4.15			
Magnesia.....					0.45	0.90					0.43		0.38	0.42			
Phosphorus.....					1.39	0.745			3.192		1.00		1.32	1.44			1.738
Sulphur.....				SiO ₂	0.051	0.009					0.003		0.005	0.01			

*Silica.

1. Selected sample of best 'ore' from pit No. 13, on the west bank of Black river.
2. Average sample taken from outcrop 1,100 feet north-east from Black river.
3. Sample from pit No. 11.
4. Sample from pit No. 10.
5. Sample from dump beside pit No. 9.
6. Sample from pit No. 9.
7. Sample selected from a 3 ton dump beside trench No. 8.

8. Sample from a 4 ft. belt of ore in trench No. 8.
- 9 and 10. Samples from trench No. 8.
11. Sample selected from a 2 ton dump beside pit No. 4.
12. Sample selected from the main belt of ore in pit No. 4.
13. Sample selected from a 1 ton dump beside pit No. 3.
14. Sample from a 4 ft. belt of ore in pit No. 3.
15. Sample selected from a 1 ton dump beside pit No. 1.
- 16 and 17. Samples from pit No. 1.

PLATE II.



No. 2 mine, Canada Iron Corporation, Torbrook, N. S.

It will be noted that in most places the ore is very low in iron, and highly siliceous. The analyses which show high iron content are from picked samples or samples from narrow bands in the ore bed.

The bed is made up of alternate narrow bands of ore and slate. The widest of these ore bands seldom attains a thickness of more than 5 feet. The aggregate thickness of ore averages about 8'-4" in a total thickness of 18'-10". These figures are deduced from sections measured by Mr. Fletcher.

Owing to the low grade character of the ore, and the difficulties of transportation, the South Mountain bed can hardly be looked upon as showing much commercial possibility.

NORTH SIDE.

The 'Shell' bed, as before stated, is magnetite, containing numerous fossils of Lower Oriskany or Eo-Devonian age. On page 14, part I. of Dr. Woodman's report, is the following average of analyses of the ore from various parts of this bed. It is compiled from analyses from various sources:—

	Percentage	Number of Analyses.
Iron.....	44.132	81
Silica.....	16.605	81
Alumina.....	4.843	6
Lime.....	6.700	7
Phosphorus.....	0.750	25
Sulphur.....	0.098	11

No. 1 Mine: Canada Iron Corporation.

There are a number of openings in this bed from which ore has been shipped, but at present no ore is being mined. The Wheelock, or No. 1 mine, of the Canada Iron Corporation, has been the chief producer. It was operated from 1905 to 1908, shipping ore to Londonderry, N.S. The thickness of the bed varies greatly in this mine, being as much as 18 feet in some places. The following is given by Dr. Woodman as the average analysis of the ore shipped:—

Iron.....	43.693 per cent.
Insoluble.....	17.460 "
Phosphorus.....	1.110 "

The highest average of analyses of shipments for any one month was for May, 1907:—

Iron.....	46.76 per cent.
Insoluble.....	15.19 "

About 3,500 feet west of the Wheelock mine the 'Shell' bed has been exposed in a trench for a distance of about 500 feet. The bed here is 4 feet wide. A general sample gives the following analysis:—

Iron.....	53.92 per cent.
Insoluble.....	8.25 "

On the west side of the Bloomington road a sample was taken from some ore lying near an old pit. It gives the following analysis:—

Iron.....	51.40 per cent.
Insoluble.....	15.37 “

The average thickness of the 'Shell' bed is 5 feet.

The Leekie bed is of hematite, practically devoid of fossils. It averages 4'-6" in thickness, but attains a maximum of 6'-6" in places. In the western part of the field the ore is slightly magnetic. An average of numerous analyses is given by Dr. Woodman, as follows:—

	Percentage.	Number of Analyses.
Iron.....	49.427	250
Silica.....	14.868	55
Alumina.....	4.168	15
Lime.....	4.235	11
Magnesia.....	0.534	9
Manganese dioxide.....	0.591	11
Phosphorus.....	0.952	75
Sulphur.....	0.071	17

No. 2 Mine: Canada Iron Corporation.

At present, the only mine being operated on this bed is No. 2 of the Canada Iron Corporation. It is situated about 2,000 feet southwest of No. 1, or Wheelock mine. The shaft is down 500 feet, with five levels on both sides. On the west side, the levels all measure about 325 feet in length; while on the east side they vary from 150 feet to 650 feet. Cross-cuts have been driven from the second and fifth levels to the 'Shell' bed, which at this point is 100 feet to the southeast. In the levels the ore is found to vary in thickness from 3'-9" to 6'-6", with an average of about 5 feet.

This mine has the following mechanical equipment:—

Five return tubular boilers, 500 H.P.

One double drum hoist.

Two single drum hoists.

Twenty-four Murphy drills.

Eleven Rand drills.

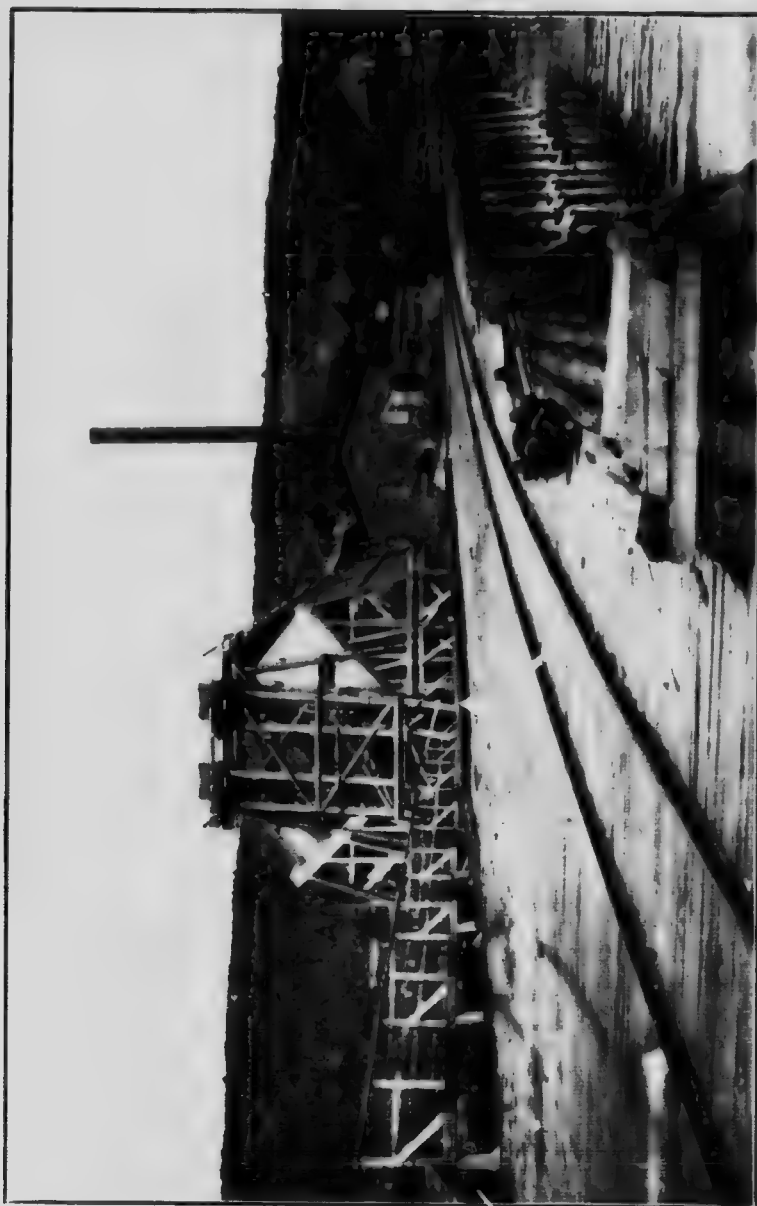
One Leonard-Ball tandem compound engine, 13" and 22" × 12" stroke. This engine runs at 250 R.P.M., which gives about 125 H.P.

Two Gates crushers, No. 6.

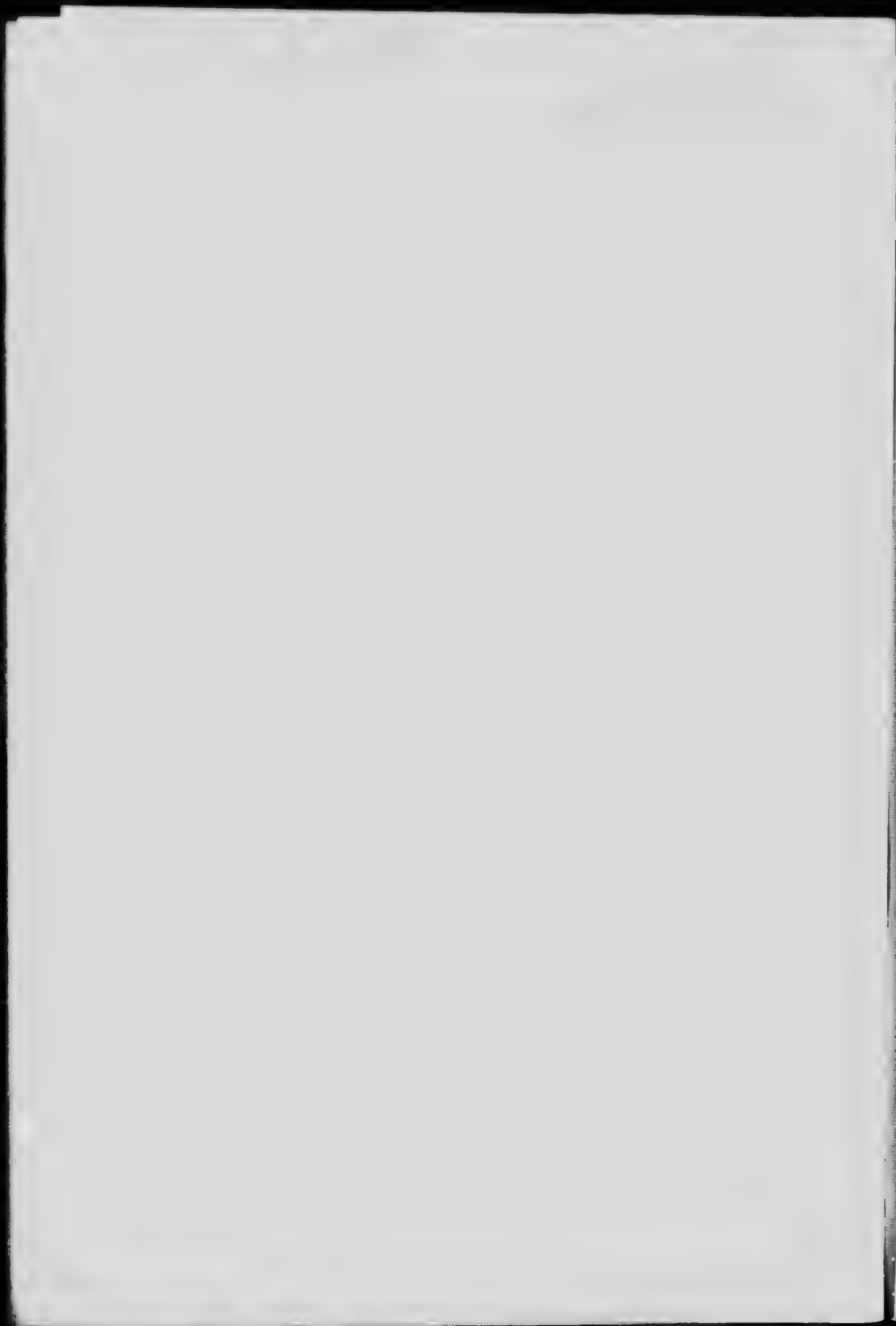
Two Zimmer picking tables, 70 feet long.

Power House.

Four return tubular boilers, 500 H.P.



Storage bins, Port Wake, N. Z.



One Laidlaw-Dunn-Gordon duplex, cross compound air compressor, capacity 1,000 cubic feet free air, delivering at 90 pounds per square inch (which can be varied to 130 pounds if necessary).

One 35 K.W. Allis-Chalmers-Bullock D.C. generator, direct connected.

Working two nine-hour shifts, this mine has an output of 200 tons per day. There are about 80 men employed underground and 50 on the surface.

All the ore raised is crushed to 3", and passed over Zimmer shaking tables, where it is hand picked. By finer crushing and further concentration, the percentage of iron might be increased materially, as the ore carries considerable attached rock.

During the past year, 11,000 tons of ore was shipped; which ran about 48 per cent in metallic iron, and 1.5 per cent in phosphorus.

The total quantity of ore raised from this mine was about 55,000 tons at the end of 1910.

Transportation.

A branch line 3½ miles long connects the Torbrook mines with the Halifax and Southwestern railway at Nictaux.

At present all the ore is shipped over the Halifax and Southwestern railway to Port Wade: a distance of 55 miles, and thence by vessel to its destination. At Port Wade, a storage bin and loader were installed during the early part of 1910. From the storage bin—which has a capacity of 7,000 tons—the ore is transferred by a bucket conveyor to a hopper at the outer end of the wharf, which delivers into the loading chutes.

Drill Holes.¹

Three drill holes are shown on the accompanying map. One is on South mountain, and two are on the north side.

No. I is on the farm of Sam. McConnell, about 3,050 feet northeast of Black river. It was sunk in 1901 by the calyx drill of the Department of Mines of Nova Scotia, to a depth of 195 feet.

¹ Information relative to drill holes is taken from Dr. Woodman's Report on the Iron Ores of Nova Scotia.

'The log below is from the original by Mr. James Phinney, drillman. A slightly different version is in Nova Scotia Mines Department Report for 1901, page 74:—¹

Material.	Length, Feet.	Total Length.
Surface detritus.....	3	3
Loose dark blue slate, first distinct core.....	20	32
Broken blue slate.....	27	59
South side of core iron, north side slate.....	3	62
Black magnetite.....	30	92
South side of core slate, north side iron.....	8	100
Hard dark slate, almost black.....	30	130
South side of core iron, north side black slate.....	3	133
Black magnetite.....	33	166
South side of core slate, north side iron.....	0	172
Hard black slate.....	23	195

The strata dipped from 83° to 87° to the northwest, and the hole was vertical. Using 85° as the average dip in reducing the above figures to the thickness of the beds, we find the first bed of ore to be 3.1 feet thick, and the second bed of ore 3.4 feet thick, with 3.2 feet of black slate intervening.

No. II drill hole is situated on the farm of Lovett Parker (formerly the Josephine Wheelock farm), to the north of the Nictaux-Torbrook road, and 17 feet south of the Shell bed. This hole, which is vertical, was sunk in 1905 by the Nova Scotia Steel and Coal Company. 'Details from the original log are not available.'

'The summary in the Nova Scotia Mines Department Report for 1905 is as follows:—

Material.	Thickness. Total length	
	Ft. In.	Ft. In.
Surface material.....	1 0	
Bluish slates.....	321 3	322 9
Shaly hematite with shells.....	8 10	331 7
Red hematite (Shell bed).....	55 4	386 11

The dip here is not given. Taken at the ore bed in a surface trench, it is 85° S.E. Much of the core was found. In most parts the stratification is parallel with the core, or vertical. The planes are extremely distinct, with much pyrite occurring in them. The bottom of the hole was still in ore.²

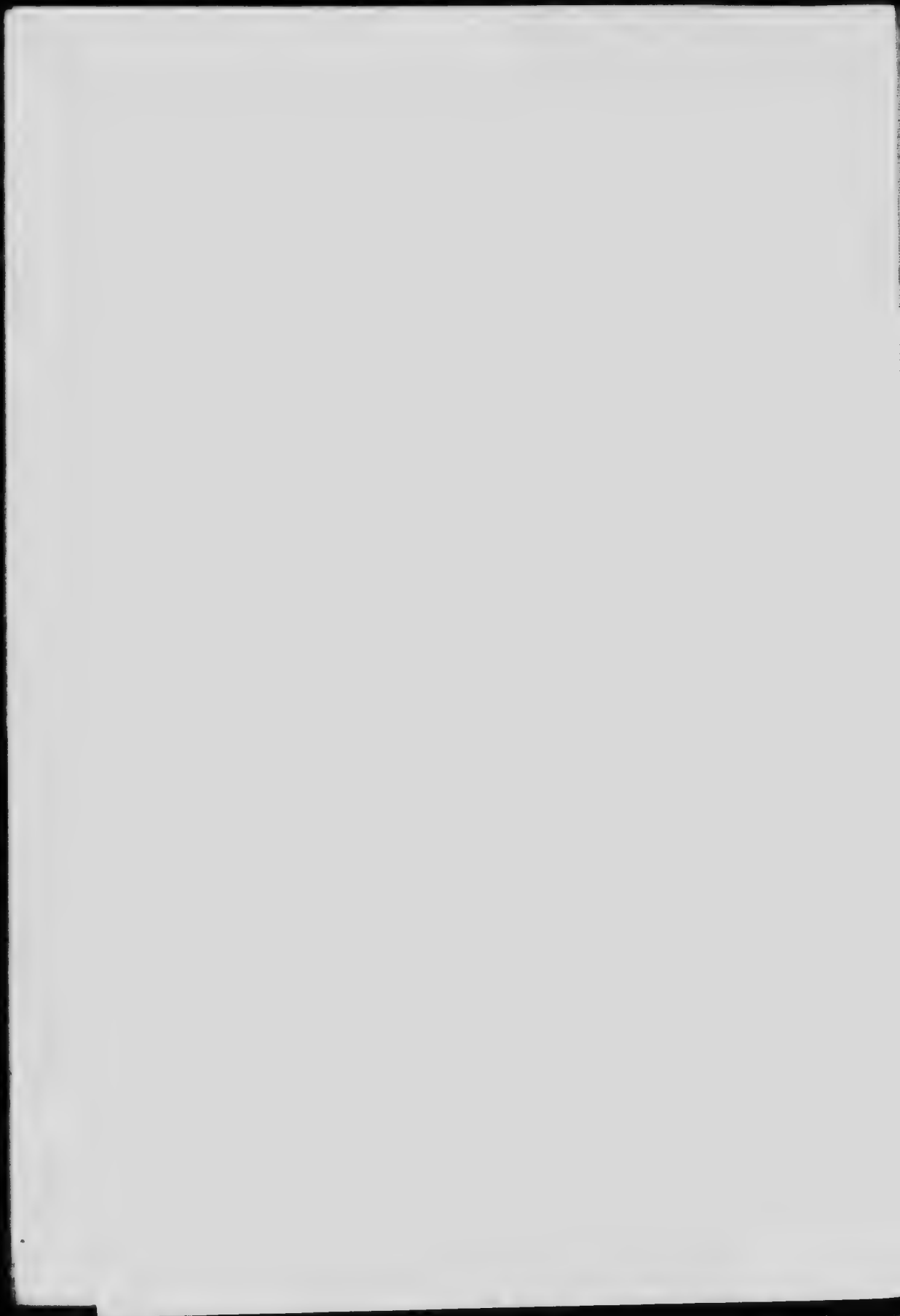
On the same property a diamond drill hole 115 feet long and inclined at 45° cut the shell bed 76 feet below the surface. The width of the bed here was slightly over 5 feet. This drill hole is not shown on the map.

¹ Iron Ores of Nova Scotia, page 118.

² Iron Ores of Nova Scotia, page 121.



Loading port, showing conveyor, Port Wad, N.S.



No. III drill hole is situated to the south of the Nietaux-Torbrook road, about 375 feet northeast of the Wheelock mine. This hole—as also Nos. I and II—was sunk by the Calyx drill of the Nova Scotia Department of Mines. The hole is vertical. 'A summary is given in the Nova Scotia Mines Department Report for 1901, page 74. The dip at the surface was 84° S.E., decreasing to 70° at the bottom.'¹

Material.	Length, Feet.	Total Length.
Surface detritus.....	11	
Broken red and blue shale.....	14	25
Red and blue shale.....	8	33
Blue shale with blotches of hematite.....	4	37
Red and grey shale, lower 10 feet with calcite seams.....	19	56
Blue and grey slate, calcite seams.....	50	106
Quartzite with calcite and pyrite.....	15	121
Magnetic brownish red hematite and quartzite, and calcite seams.....	13	134
Fossiliferous magnetic red hematite, some calcite.....	11	145
Ditto, with increasing amount of grey slate on north side.....	16	161
Dark red quartzite.....	4	165
Grey slate and quartzite, much broken.....	15	180
Grey and blue slate lower part chiefly blue with some quartzite and pyrite.....	131	311
Red hematite.....	46	357
Red hematite and red and blue slate.....	16	373
Red and grey slate.....	10	383
Ditto, with streaks of hematite.....	14	397
Red shale and hematite.....	31	428
Blue slate.....	8	436
Blue slate and hematite.....	4	440
Red hematite.....	24	464
Red hematite, with red shale.....	3	467
Red hematite.....	4	471
Red hematite, with red shale.....	5	476
Red hematite and blue shale.....	6	482
Blue shale, lower part with calcite seams.....	79	561
Blue shale and quartzite.....	70	631

Magnetic Concentration Tests.

Magnetic concentration tests by the Gröndal method of separation have been carried on by Mr. G. C. Mackenzie in the testing laboratories of the Department of Mines at Ottawa, upon samples of Torbrook ore, both from the Hematite and Shell ore veins, results of which will be published in a separate report.

¹ Iron ores of Nova Scotia, page 120.

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REPORTS, AND MAPS OF ECONOMIC INTEREST.

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1. Mining Conditions of the Klondike, Yukon. Report on—by Eugene Haanel, Ph.D., 1902.
2. Great Landslide at Frank, Alta. Report on—by R. G. McConnell and R. W. Brock, M.A., 1903.
3. Investigation of the different electro-thermic processes for the smelting of iron ores, and the making of steel, in operation in Europe. Report of Special Commission—by Eugene Haanel, Ph.D., 1904. (Out of print.)
4. Rapport de la Commission nommée pour étudier les divers procédés électro-thermiques pour la réduction des minerais de fer et la fabrication de l'acier employés en Europe. (French Edition), 1905. (Out of print.)
5. On the location and examination of magnetic ore deposits by magnetometric measurements—by Eugene Haanel, Ph.D., 1904.
7. Limestones, and the Lime Industry of Manitoba. Preliminary Report on—by J. W. Wells, 1905.
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9. Hydraulic Cements (Raw Materials) in Manitoba: Manufacture and Uses of. Preliminary Report on—by J. W. Wells, 1905.
10. Mica: Its Occurrence, Exploitation, and Uses—by Fritz Cirkel, M.E., 1905. (Out of print.)
11. Asbestos: Its Occurrence, Exploitation, and Uses—by Fritz Cirkel, M.E., 1905. (Out of print: see No. 69.)
12. Zinc Resources of British Columbia and the Conditions affecting their Exploitation. Report of the Commission appointed to investigate—by W. R. Ingalls, 1905.
16. Experiments made at Sault Ste. Marie, under Government auspices, in the smelting of Canadian iron ores by the electro-thermic process. Final Report on—by Eugene Haanel, Ph.D., 1907.
17. Mines of the Silver-Cobalt Ores of the Cobalt district: Their Present and Prospective Output. Report on—by Eugene Haanel, Ph.D., 1907.
18. Graphite: Its Properties, Occurrence, Refining, and Uses—by Fritz Cirkel, M.E., 1907.
19. Peat and Lignite: Their Manufacture and Uses in Europe—by Erik Nyström, M.E., 1908.

20. **Iron Ore Deposits of Nova Scotia.** Report on (Part I)—by Dr. J. E. Woodman.
21. **Summary Report of Mines Branch, 1907-8.**
22. **Iron Ore Deposits of Thunder Bay and Rainy River districts.** Report on—by F. Hille, M.E.
23. **Iron Ore Deposits along the Ottawa (Quebec side) and Gatineau rivers.** Report on—by Fritz Cirkel, M.E.
24. **General Report on the Mining and Metallurgical Industries of Canada, 1907-8.**
25. **The Tungsten Ores of Canada.** Report on—by Dr. T. L. Walker.
26. **The Mineral Production of Canada, 1906.** Annual Report on—by John McLeish, B.A.
27. **The Mineral Production of Canada, 1908.** Preliminary Report on—by John McLeish, B.A.
28. **Summary Report of Mines Branch, 1908.**
29. **Chrome Iron Ore Deposits of the Eastern Townships.** Monograph on—by Fritz Cirkel, M.E. (Supplementary Section: Experiments with Chromite at McGill University—by Dr. J. B. Porter.)
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71. Investigation of the Peat Bogs, and Peat Industry of Canada, 1909-10: to which is appended Mr. Alf. Larson's Paper on Dr. M. Ekenberg's Wet-Carbonizing Process: from Teknisk Tidskrift, No. 12, December 26, 1908—translation by Mr. A. Anrep, Jr.; also a translation of Lieut. Ekelund's Pamphlet entitled 'A Solution of the Peat Problem,' 1909, describing the Ekelund Process for the Manufacture of Peat Powder, by Harold A. Leverin, Ch.E. Bulletin No. 4—by A. Anrep, Peat Expert. (Second Edition, enlarged.)
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83. An investigation of the Coals of Canada with reference to their Economic Qualities: as conducted at McGill University under the auspices of

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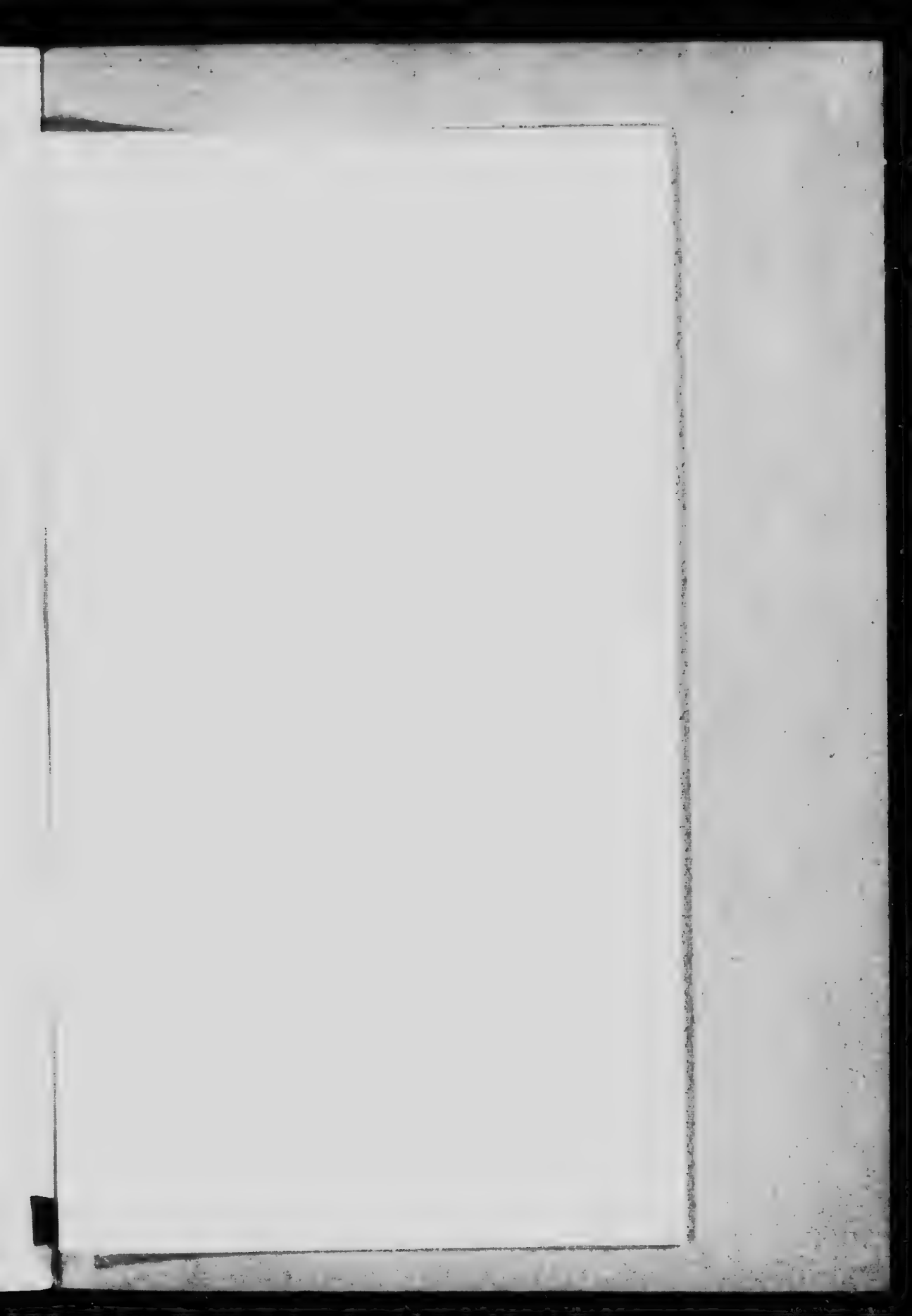
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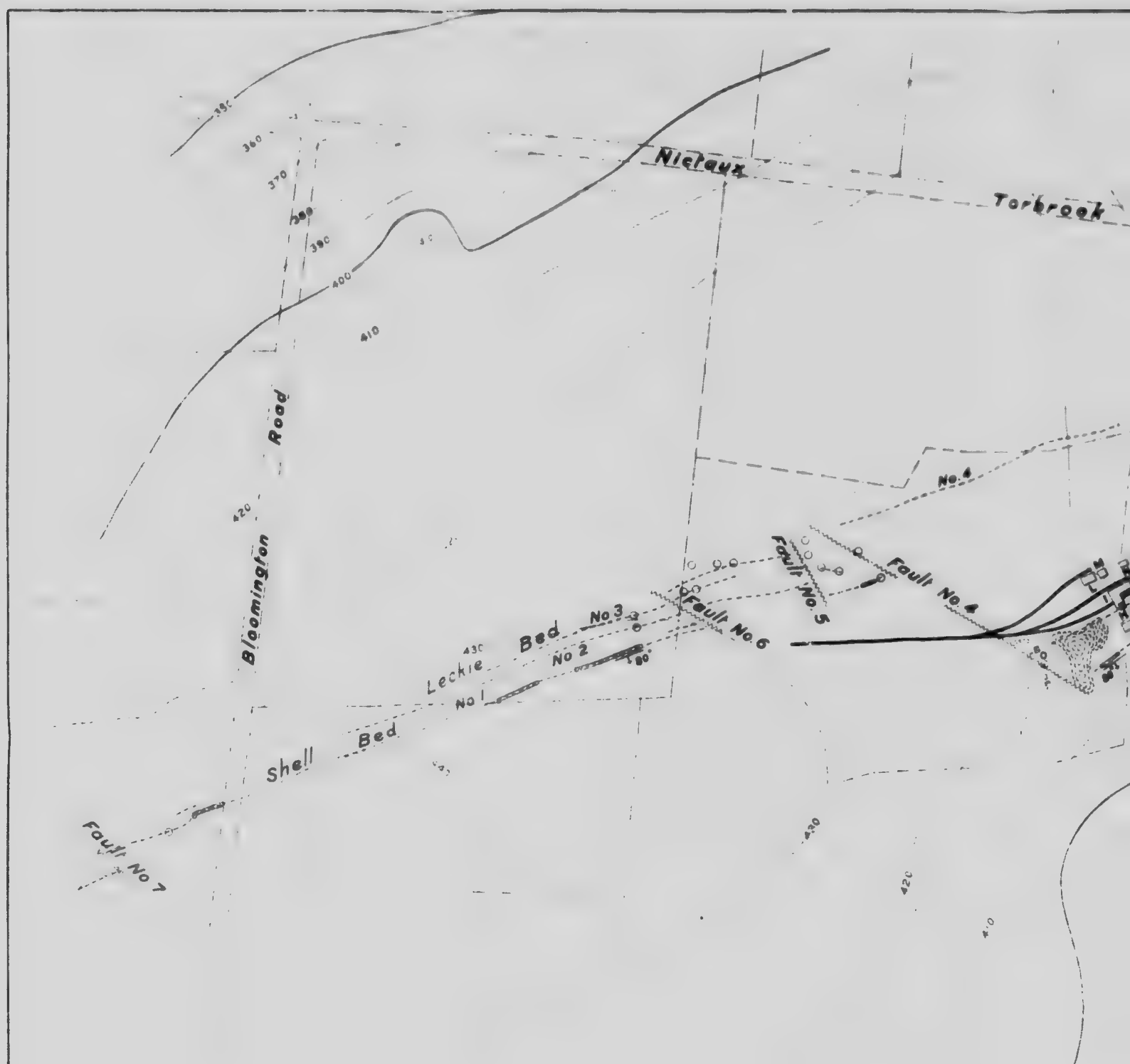
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MAP
OF
SOUTHWEST PART
OF

HON W TEMPLEMAN MINISTER A P L O A D DEPUTY MINISTER
EUGENE MAANEL PH D REGION

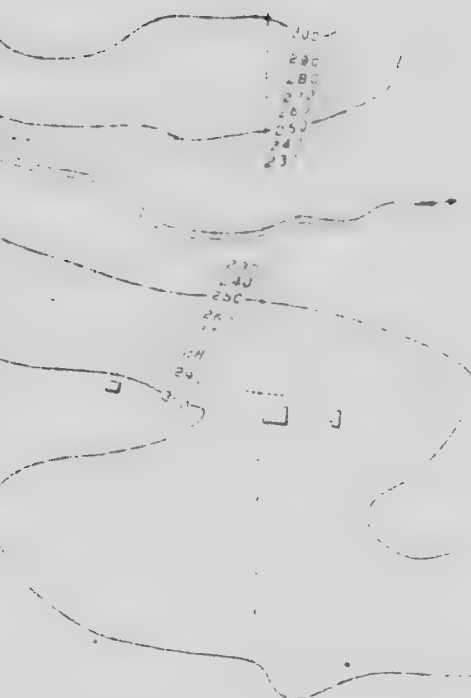


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Railway to Nictaux

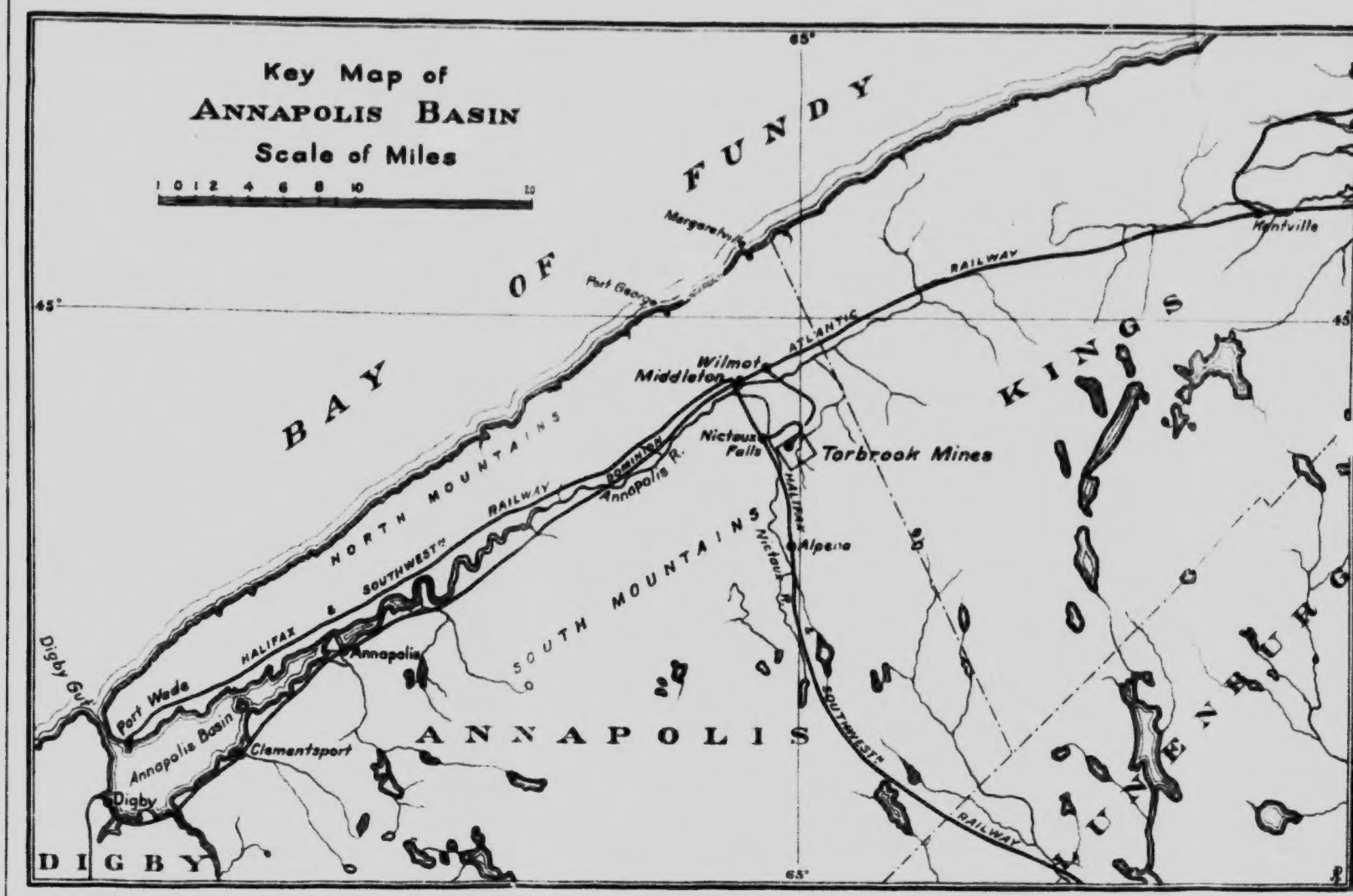
Lat. North



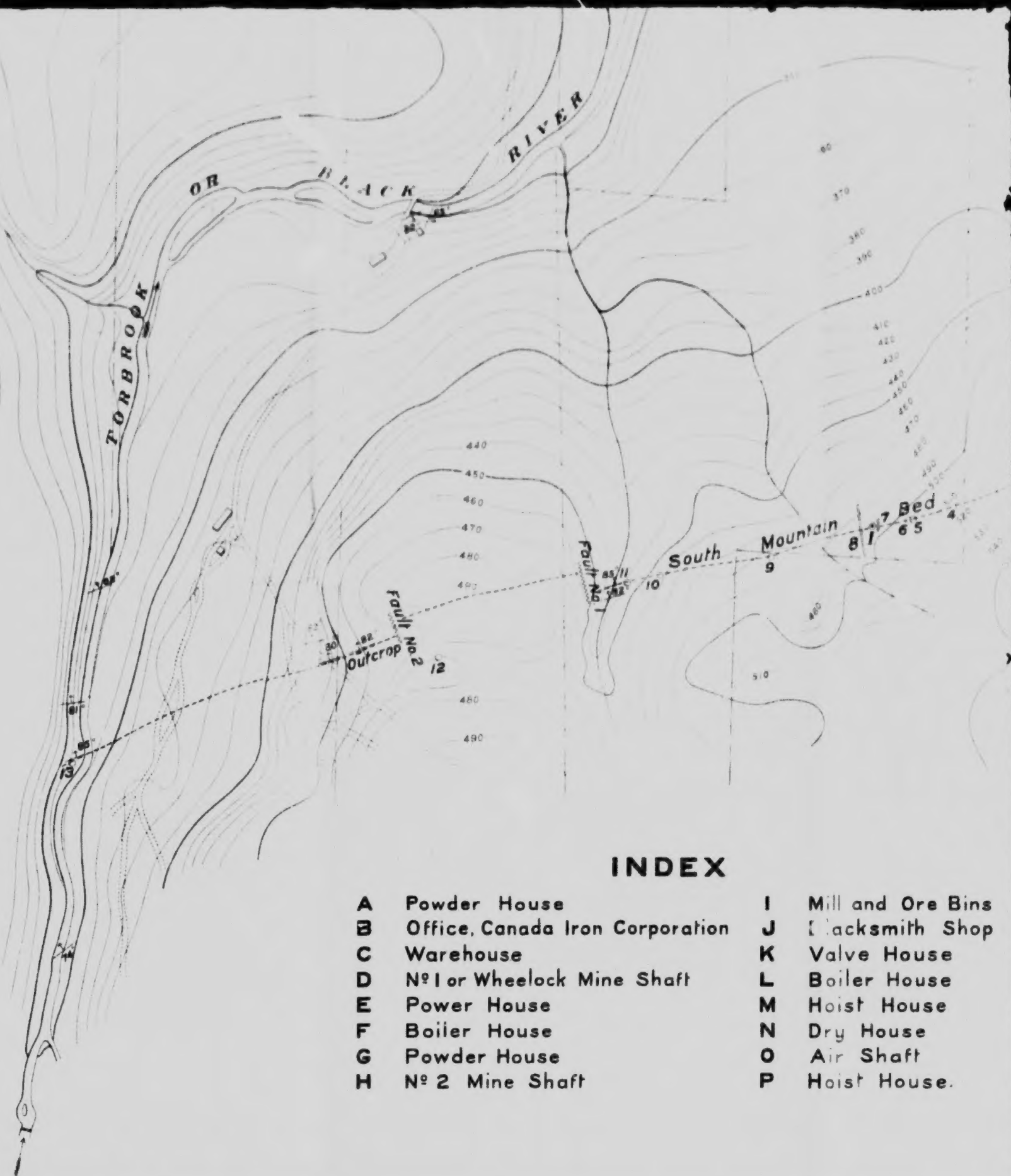
MAP OF SOUTHWEST PART OF TORBROOK IRON-BEARING DISTRICT ANNAPOLIS COUNTY NOVA SCOTIA

Surveyed by Howells Fréchette, M.Sc.
1910

Scale of Feet

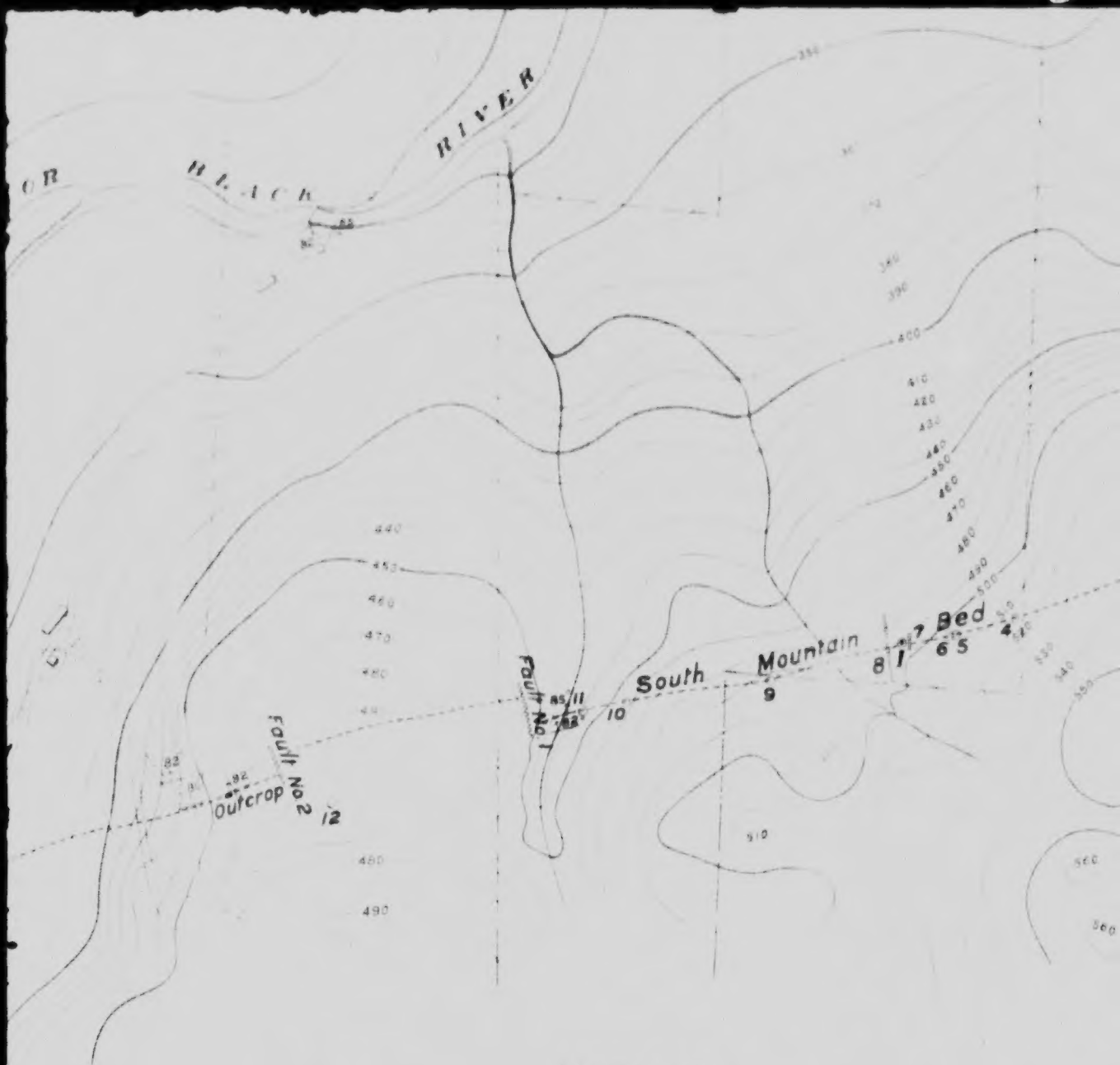


L. H.S. Pereira, Draughtsman
H.E. Bane, Chief Draughtsman



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LEGEND

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- — Pits and Trenches
- ☒ Shafts
- Drill Holes
- ~~~~~ Faults
- ⊗ Ore and Rock Dumps
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